

REMARKS

In an Office action of October 7, 2002, the Examiner objects to the drawings and the specification. In response, Applicant submits the present amendment and remarks. A marked-up version of the amendment showing the changes made is also enclosed. The Examiner's reconsideration is respectfully requested in view of the amendment and remarks.

Applicant gratefully acknowledges the Examiner's allowance of all pending claims 1-20.

Drawings Objection:

The drawings are objected to under 37 CFR 1.83(a) because they allegedly fail to show reference 9 as described in the specification on page 13, line 23. Further, the drawings were objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "8" has been used to designate both fibers on page 13, line 21 and light guides on page 14, line 4.

In reply, Fig. 1 is amended to properly indicate the reference numeral "9" as designating an illumination device 9, as described on page 13, line 23 of the specification. To further address the Examiner's concerns, the specification is amended at page 13, line 21 to change "eight individual fibers 8" to "eight individual fibers constituting eight light guides 8". Accordingly, the Figures satisfy the provisions of §§1.83 and 1.84. Thus, withdrawal of the objection is respectfully requested.

Specification Objection:

The specification is objected to for the following informalities: the term "as" on page 3, lines 30 and the references to specific claims throughout the specification.

In reply, the specification is amended to change "as" on page 3, line 30 to "and", and to delete the references to specific claims throughout the specification, as suggested by the Examiner. Thus, withdrawal of the objection is respectfully requested.

In view of the foregoing amendments and remarks, it is respectfully submitted that the drawings and specification in the application are in condition for allowance. Early and favorable reconsideration is respectfully requested.

If there are any charges due with respect to this response, please charge them to Deposit Account No. 06-1130 maintained by Applicant's Attorneys.

Respectfully submitted,

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MARKED-UP VERSION OF AMENDMENTS

IN THE SPECIFICATION:

Please amend the last paragraph on page 3 of the specification, as follows:

“ EP 0 676 275 discloses a DMD-based stereolithographic device comprising a plurality of illumination modules, each module comprising a dedicated light source. By varying the number of the utilized modules, an arbitrary size and form of the illumination head may be obtained. However, the device has the disadvantage of being voluminous and quite expensive. Moreover, the mutual variation of the light sources results in a different degree of illumination of the various illuminated sub-areas, and consequently in both underexposure and overexposure of as well the vertical [as]and horizontal plane of the illuminated surface.”

Please amend the fifth complete paragraph on page 5 of the specification, as follows:

“By[, as specified in claim 1,] illuminating the sub-areas it is possible to obtain an effective sum of the number of sub-areas.”

Please amend the fourth paragraph on page 6 of the specification, as follows:

“By[, as specified in claim 2,] letting each spatial modulator arrangement comprise transmissive light valves, it is possible to obtain an additional advantageous embodiment, according to the invention. By using light guides, the above-mentioned advantage of easy replacement of the illumination modules will be distinct as the mutual alignment of the

illumination modules only requires a supplementary uncritical assembly or disassembly of the light-emitting end of a light source. Thus, no critical calibration of the illumination system is needed.”

Please amend the fourth and fifth paragraphs on page 8 of the specification, as follows:

“By[, as specified in claim 3,] letting the apparatus comprise a first lens arrangement, said first lens arrangement comprising at least one microlens arranged with respect to each light valve in such a manner that that the emitted light by the light guide(s) (8) focuses on or in proximity of the optical axis of the individual light valves, it is possible to obtain a high degree of utilization of the light effect and rapid transit times generated by the light source.

By[, as specified in claim 4,] letting the rapid prototyping apparatus comprise a second micro lens arrangement between the light valves and the illumination surface in such a manner that light transmitted through the light channels of the individual light valves is suitably focused on the illumination surface, it is possible to transmit the light from each channel in smaller dots with high intensity on the illumination surface.”

Please amend the fourth to eighth paragraphs on page 9 of the specification, as follows:

“By[, as specified in claim 5,] letting the light guides consist of preferably multi mode fibers, it is possible to obtain a limited loss of illumination intensity and great flexibility in the design by the spacious placing of the individual elements.

By using multi mode fibers it also becomes possible to illuminate the illumination surface with a wide spectrum of light.

By[, as specified in claim 6,] letting at least one of the light sources consist of a short arc gap lamp, a high emitted light effect from an area of a limited physical scope is obtained (high radiation power).

By[, as specified in claim 7,] letting the [the] individual light valves be arranged in rows in the transverse direction of the surface at a given mutual distance, said rows being mutually displaced in the transverse direction, it becomes possible to divide the light linearly and broadly.

By[, as specified in claim 8,] arranging the rows in such a manner that the projection on the transverse direction of the surface provided by the light valves results in a number of illumination points at a given mutual distance in the transverse direction, it becomes possible to emit light in dots with a significantly improved resolution than would have been the case if it had been determined by the physical extent of the valves and if placed in one single transverse directional row.”

Please amend the first to fifth paragraphs on page 10 of the specification, as follows:

“By[, as specified in claim 9,] letting the surface profile(s) of the spatial modulator arrangements be arranged on one or more exposure heads, said exposure heads and said illumination surface being designed to make a relative movement, said rapid prototyping

apparatus being provided with a control circuitry for control of the spatial light modulator arrangement in dependency of the movement between the exposure head and the illumination surface, an advantageous embodiment is obtained, according to the invention.

By[, as specified in claim 10,] letting the exposure head(s) comprise a bar whose movement over the illumination surface consists of one single progressing movement in the transverse direction of the bar, it is possible to create illuminated dots covering the entire or a significant part of the illumination surface due to the scanning movement.

By[, as specified in claim 11,] letting the illumination device between the spatial light modulator arrangement and the illumination surface comprise additional optical means for the spreading of light beams provided by spatial light modulator arrangement over the illumination surface, it becomes possible to expose an area which is physically larger than the area covered by the light channels whereby non-active edge areas around a light valve arrangement may also be illuminated.

By[, as specified in claim 12,] letting the spatial light modulator arrangement of the illumination unit be made of spatial light valves such as LCD, PDLC, PLZT, FELCD or Kerr cells, great design flexibility is obtained in relation to the light modulator principle of the individual applications which makes the manufacturing of standardized components cheaper.

By[, as specified in claim 13,] letting the spatial light modulator arrangement of the illumination device consist of reflective electromechanical light valves such as DMD, it is possible to obtain another advantageous embodiment of the invention which is based on commercially wide-spread technologies.”

Please amend the second and third paragraphs on page 11 of the specification, as follows:

“By[, as specified in claim 14,] letting the light guides of the illumination unit be arranged with respect to the spatial light modulator arrangement in such a manner that the furnished optical energy for each subset of light modulators does not vary significantly once the subsets of light modulators illuminate adjacent sub-areas in close proximity to each other on the illumination surface, the allowed variation in light intensity between all light sources is obtained and may be increased without being visible.

The invention also relates to a method[, as specified in claim 15,] of the manufacturing of three dimensional objects by means of a rapid prototyping apparatus where at least one light source is optically coupled with a plurality of light guides arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section.”

Please amend the last paragraph on page 11 continuing to page 12 and the second paragraph on page 12 of the specification, as follows:

“By[, as specified in claim 16,] letting the wholly or partially light-sensitive material be placed as a layer on a plate in a container and subsequently expose it to the RP device

before placing a new layer on top of the previous layer, a gradual build-up of the desired prototype is obtained. According to the invention, the method allows for the construction of one layer and joining it with a previous layer in one single work process.

By[, as specified in claim 17,] letting the RP device comprise a computer-aided design program capable of converting the 3D representation of the prototype to be constructed into files containing a cross section of the prototype, the contents of said files being used to control the controllable light modulators, it is possible to convert e.g. graphic representations into a given prototype. This process takes place at a very slow conversion speed, according to the invention.”

Please amend the fourth paragraph on page 13 of the specification, as follows:

“ The light source arrangement 6 is optically connected with bundles 7 of optical multi mode fibers. These bundles 7 spread into eight individual fibers [8] constituting eight light guides 8 where each fiber illuminates a microshutter arrangement of e.g. 588 micromechanical light valves. Thus, in unison, the eight individual fibers illuminate an illumination device 9 comprising eight microshutter arrangements, each constituting an individual area of the entire microshutter arrangement. ”